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Site Specific Flood Risk Assessment Report

June 2022

Project Number: 1968

Issue 07

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1 Introduction

1.1 Background

CORA Consulting Engineers were commissioned by the Seabren Developments Ltd and Circle VHA CLG to prepare a Site-Specific Flood Risk Assessment (SSFRA) for the proposed demolition of existing industrial units and construction of a new multi-storey residential develoment at Glebe House, Crumlin. This SSFRA was prepared to comply with current planning legislation and forms part of the proposed planning application for the subject site.

1.2 Objectives

The objectives of this report are to inform the planning authority regarding flood risk for the potential development of the lands. The report will assess the site and development proposals in accordance with the requirements of "*The Planning System and Flood Risk Management Guidelines for Planning Authorities"*.

The report will provide the following;

- The site's flood zone category.
- Information to allow an informed decision of the planning application in the context of flood risk.
- Appropriate flood risk mitigation and management measures for any residual flood risk.

1.3 Flood Risk Assessment Scope

This SSFRA relates only to the proposed development site in the vicinity of St. Agnes Road and its immediate surroundings. This report uses information obtained from various sources, together with an assessment of flood risk for the existing land and proposed development. The report follows the requirements of '*The Planning System & Flood Risk Management – Guidelines for Planning Authorities',* (referred to as the *Guidelines* for the remainder of this report) and the Dublin City Council Development Plan 2016-2022 Strategic Flood Risk Assessment (SFRA).

1.4 Existing Site

The proposed site is located on St. Agnes Road, Crumlin, Dublin 16. The site covers an area of approximately 8495m^2 and is currently developed as industrial premises with an open yard areas.

Generally, the site is flat with a current ground floor level varying from +45.10m AOD to +45.40m AOD across the existing yards rising slightly from North to South. The existing lowest floor level to Glebe house is +43.95m AOD. The lower ground floor level is accessed via a stair well and light well to the North of house.

Figure 1.1 - Site Location

As per Dublin City Council Development Plan 2016 - 2022 the site has been zoned Z1 Sustainable Residential Neighbourhoods, '*to protect, provide and improve residential amenies.*

The site is located on the south of St. Agnes Road, Crumlin. The nearest Watercourses are the Camac River, Poddle River and Walkinstown stream located approximately 0.6km, 1.4km and 12km respectively.

Figure 1.2 - Extract from EPA Online Mapping

1.5 Proposed Development

Seabren Developments Ltd and Circle VHA CLG intend to apply to An Bord Pleanála for planning permission for a strategic housing development at this site located at Glebe House (Protected Structure, RPS Ref. 7560), including the vacant Glebe light industrial lands, and the vacant site of the former Coruba House, Saint Agnes Road, Crumlin, Dublin 12 all on a site of 0.88 Hectares. The site bounds Somerville Drive and Somerville Green to the southeast and southwest, respectively, and includes the grass margin between the Coruba site boundary and Somerville Drive. The Glebe House lies within the Crumlin Architectural Conservation Area.

A residential development of 150 no. apartments consisting of 74 one beds, 72 two beds and 4 three bed residential units, a creche and café. The proposed scheme has an overall Gross Floor Area of 15,767 sq.m.

Two apartment buildings are proposed ranging in height from 4 – 6 storeys and linked by a carpark at ground floor and a podium at first floor level comprising the following:

- Block A is 5-6 storeys and consists of 79 apartments and includes 35 no. one beds and 44 no. two beds units, ESB substation/switch room/metering room of 85sqm, 42 no. secure bicycle storage and bin storage of 44sqm

- Block B is 4-5 storeys and consists of 66 apartments and includes 38 no. one beds, 25no. two beds and 3 no. three beds, a Creche of 147 sqm at ground floor level with associated outdoor area, ground floor plant rooms of 74sqm, ESB substations/switch room/metering room/telecoms of 89sqm, 188 no. secure bicycle storage spaces in two locations, 6 no. motorbike spaces and bin storage of 75sqm.

Two no.three storey pavilion buildings either side of Glebe House to accommodate:

- One number two storey duplex 2 bed apartment above one number 1 bed apartment at ground floor in the north west pavilion and,
- One number two storey duplex 2 bed apartment above a 55 sqm ground floor café, in the south east pavilion.

The repair of fire damaged elements (following a fire 21st April 2022) and the refurbishment of Glebe House, a protected structure, into two apartments, one number 2 bed unit at lower ground floor and one number 3 bed unit at upper ground and first floor;

- Repair of fire damaged elements including the replacement of all roof coverings and structure, replacement of all first floor timber stud walls, replacement of first floor rear return joists, replacement/repair of floor joists at first floor level, replacement of internal render to kitchen/dining area in rear return building and replacement/repair of stair from upper ground to first floor level,

- the refurbishment of Glebe House including the removal of extensions to the rear and sides of the building, restoration of the façade, replacement of pvc windows with sliding sash windows and associated works to the interior and to the curtilage of Glebe House.

- Lowering the front boundary wall and return boundary wall to the front of Glebe House.

Demolition of all workshops, offices and sheds to the rear and sides of Glebe House Demolition of boundary walls around the Coruba land on Somerville Drive, the front entrance and between Coruba and the Glebe lands. Demolition of non-original brick column's at St Agnes Road entrance to Glebe House (1,636 sqm).

75 car parking spaces are proposed:

- 66 no. car parking spaces (includes 2 Go Car spaces) in ground floor car park below podium and partly in Block A and 4 No. visitor car parking spaces in front of Glebe House all with vehicular access from St Agnes's Road
- 5 No. assigned car parking spaces on the eastern side of Block B with vehicular access from Somerville Drive.

The development provides 905 sqm of Public Open Space to the front and side of Glebe House, and within the southeast public plaza. with a pedestrian route to the side of the Café at Pavilion B and 1,632 sqm of Communal Open Space located at podium level and to the rear of Block A.

- 76 no. visitor bicycle parking spaces are provided in the public accessible areas of the site.

The application also includes the provision of a new footpath along the south-eastern boundary at Somerville Drive, a new controlled gate between Somerville Drive and St Agnes Road allowing public access through the site within daylight hours and a new pedestrian access from the public open space onto St. Agnes Road, boundary treatment, landscaping, Solar Panels on the roof of Blocks A and B, provision of 4 no. Microwave link dishes to be mounted on 2 No. steel support posts affixed to the lift shaft overrun on Block A, lighting, services and connections, waste management and other ancillary site development works to facilitate the proposed development.

2 Planning Guidelines and Flood Risk Assessment

2.1 The Planning System and Flood Risk Management, Guidelines for Planning Authorities

The FRM Guidelines provide “mechanisms for the incorporation of flood risk identification, assessment and management into the planning process….” They ensure a consistent approach throughout the country requiring identification of flood risk and flood risk assessment to be key considerations when preparing development plans, local area plans and planned development.

“The core objectives of the FRM Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding.
- Avoid new developments increasing flood risk elsewhere.
- Ensure effective management of residual risks for development permitted in floodplains.
- Avoid unnecessary restriction of national, regional or local economic and social growth.
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure the requirements of EU and national law in relation to the natural environment and nature conservation are complied with for flood risk management.”

The key principles of The FRM Guidelines are to apply the Sequential Approach to the planning process i.e.;

- “Avoid the risk, where possible,
- Substitute less vulnerable uses, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible.”

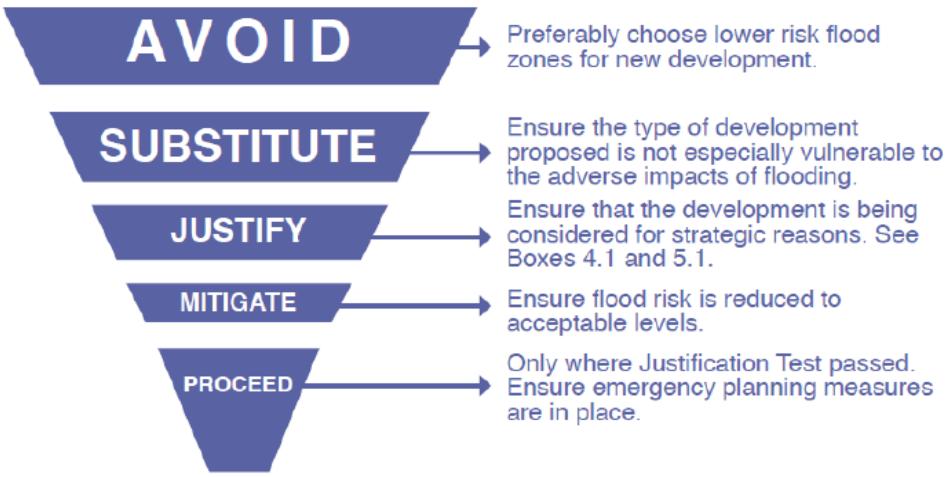


Figure 2.1 - Sequential Approach Principles in Flood Risk Management

Where the *Sequential Test's* **avoid** and **substitute** principals are not appropriate then the FRM Guidelines propose that a *Justification Test* be applied to assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk.

2.1.1 Flood Risk Assessment

The assessment of flood risk requires an understanding of where water comes from (the source), how and where it flows (the pathways) and the people and assets affected by it (the receptors).

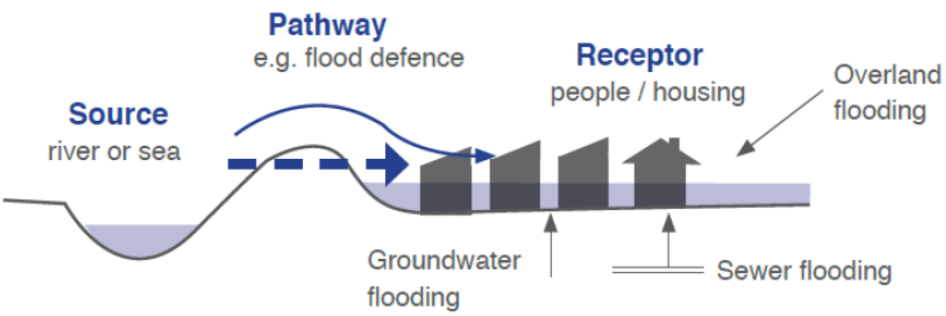


Figure 2.2 - Source - Pathway - Receptor Model

The principal sources are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. The receptors can include people, their property and the environment. All three elements are examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine potential consequences. Mitigation measures typically used in development management can reduce the impact of flooding on people and communities e.g. by blocking or impeding pathways. The planning process is primarily concerned with the location of receptors and potential sources and pathways that might put those receptors at risk.

Risks to people, property and the environment should be assessed over the full range of probabilities, including extreme events. Flood risk assessment should cover all sources of flooding, including effects of run-off from a development locally and beyond the development site.

2.2 Flood Risk Assessment Stages

The FRM Guidelines outline that a staged approach should be adopted when carrying out a flood risk appraisal or assessment. “These stages are:

- *Stage 1 Flood risk identification*
- *Stage 2 Initial flood risk assessment*
- *Stage 3 Detailed flood risk assessment*

The FRM Guidelines require a SSFRA be undertaken to assess flood risk for individual planning applications. This SSFRA comprises Stages 1, 2 and 3 involving both identification and more detailed assessment of flood risks and surface water management related to the planned development site.

2.3 Flood Zones

The FRM Guidelines use flood zones to determine the likelihood of flooding and for flood risk management within the planning process. The three flood zone levels are:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% AEP (Annual Exceedance Probability) or 1 in 100 for river flooding;
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding or between 0.1% AEP or 1 in 1000 and 0.5% AEP or 1 in 200 for coastal flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas outside zones A and B.

The FRM Guidelines categorises all types of development as either;

- Highly Vulnerable e.g. dwellings, hospitals, fire stations, essential infrastructure,
- Less Vulnerable e.g. retail, commercial or industrial buildings, local transport infrastructure.
- Water Compatible e.g. flood infrastructure, docks, amenity open space.

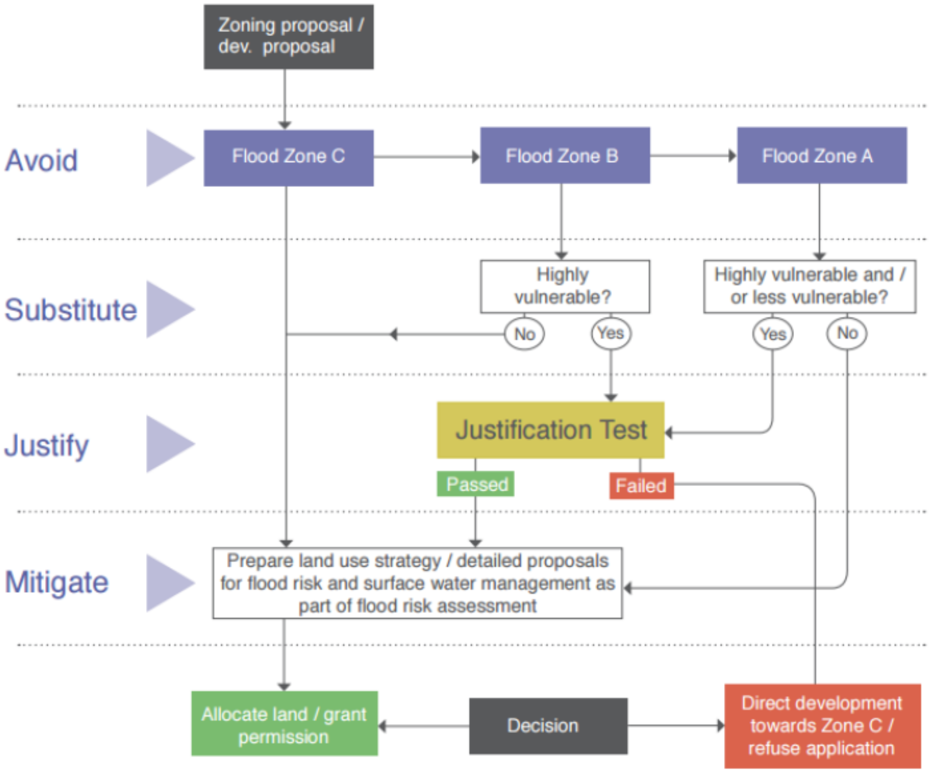


Figure 2.3 - Sequential Approach Mechanism in the Planning Process

The Sequential Approach restricts development types to occur within the flood zone appropriate to their vulnerability class, see figure 2.4.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

Figure 2.4 - Table 3.2 from the FRM guidelines - Matrix of Vulnerability versus Flood Zone to illustrate appropriate development and that required to meet the Justification Test

2.4 Proposed Development's Vulnerability

The proposed type of development for this site is to be predominantly residential along with the inclusion of a creche and café. Residential developments are categorised as **highly vulnerable** and appropriate to be located just within Flood Zone C. To provide highly vulnerable within Flood Zone C **No Justification Test** is required.

2.5 Site Specific Flood Risk Assessment for Development.

The FRM Guidelines require a SSFRA to “gather relevant information sufficient to identify and assess all sources of flood risk and the impact of drainage from the proposal”. It should “quantify the risks and the effects of any necessary mitigation, together with the measures needed or proposed to manage residual risks”. It considers the nature of flood hazard, taking account of the presence of any flood risk management measures such as flood protection schemes and how development will reduce the flood risk to acceptable levels. A detailed assessment for a development application should conclude that the core flood risk elements of the Justification Test are passed and that residual risks can be successfully managed with no unacceptable impacts on adjacent lands.

2.6 SSFRA Key Outputs

Key outputs of an SSFRA are:

- Plans showing the site and development proposals including its relationship with watercourses and structures which may influence local hydraulics;
- Surveys of site levels and comparison of development levels relative to sources of flooding and likely flood water levels;
- Assessments of;
    - Potential sources of flood risk;
    - Existing flood alleviation measures;
    - Potential impact of flooding on the site.
- How the layout and form of the development can reduce those impacts, including arrangements for safe access and egress.
- Proposals for surface water management and sustainable drainage.
- The effectiveness and impact of any mitigation measures.
- The residual risks to the site after the construction of any necessary measures and the means of managing those risks; and
- How flood risks are managed for occupants / employees of the site and its infrastructure.

3 Stage 1 Flood Risk Identification

3.1 Available Flood Risk Information

The initial flood risk identification stage uses existing information to identify and confirm whether there may be flooding or surface water management issues for the lands in question that may warrant further investigation.

To initially identify potential flood risks for the existing site and surrounding area a number of available data sources were consulted, these are listed in Table 3.1 below.

	Information Source	Coverage	Quality	Confidence	Identified Flood Risks	Flood Risk
Primary Data Source and Modelled Data	OPW ECFRAM – Fluvial https://www.floodinfo.ie/map/floodmaps/	Regional	High	High	Flood maps indicate that the development is not at risk of Fluvial Flooding	N
	OPW ECFRAM – Tidal https://www.floodinfo.ie/map/floodmaps/	Regional	High	High	Tidal flood maps indicate that the subject site is outside Tidal Flood Zones	N
	OPW ECFRAM – Pluvial https://www.floodinfo.ie/map/floodmaps/	Regional	High	High	Pluvial Flood Maps indicate minor flooding to areas of the site.	Y
	ICPSS	Nationwide	Moderate to High	Moderate to High	ICPSS maps indicate that the site is located outside Tidal Flood Zones.	N
	DCC Development Plan SFRA	Local	Moderate to High	Moderate to High	Development is located within Flood Zone C.	N
Secondary Data Source	Walkover Survey	Local	Varies	Varies	Hardstanding former industrial units with slight fall from centre of site. All drainage underground.	N
	OPW Historic Flood Records	Nationwide	Varies	Varies	No records of site flooding.	N
	Historic OSI Maps	Nationwide	Moderate	Low	Site occupied with structure for over a century	N
	EPA Ex. Rivers	Nationwide	Moderate	Moderate	N/A	N
	Drainage Records	Nationwide	Moderate	Moderate	Proposed below ground drainage connection to Somerville Drive.	N
	Geological Survey Ireland Maps	County	Moderate	Low	Made ground over gravel layers.	N
	Topographic Surveys	Local	High	High	Average site level +45.00m AOD.	N

Table 3-1 - Review of Available Information

3.2 Identified Flood Risks/ Flood Sources

3.2.1 OPW Predictive, Historic & Benefitting Land Maps and Flood Risk Information

From consultation of flood information from the OPW's floodmaps.ie website the site has not suffered from flooding in the past. Information from this source on previous flood events has been included in Appendix A which shows some flooding incidents in other areas of the city. However, there are no records of the site itself having been flooded.

<u>Fluvial Flood Risk</u>

The OPW's Eastern CFRAM study produced flood risk maps and the assessment of fluvial flood plains over the eastern region of Ireland. The OPW have consolidated this information onto the https://www.floodinfo.ie/map/floodmaps/ website.

Figure 3.1 below shows that the site is outside the 0.1% AEP, 1.0% AEP and 10% AEP fluvial flood events. Further information is also included in relation to flood levels associated with an increase in rainfall due to future climate change. Figure 3.2 represents the flood extents with an allowance for a twenty percent increase in rainfall in the future. The information provided on the map indicates that there will be no impact on the proposed development site due to fluvial flooding when considering climate change.

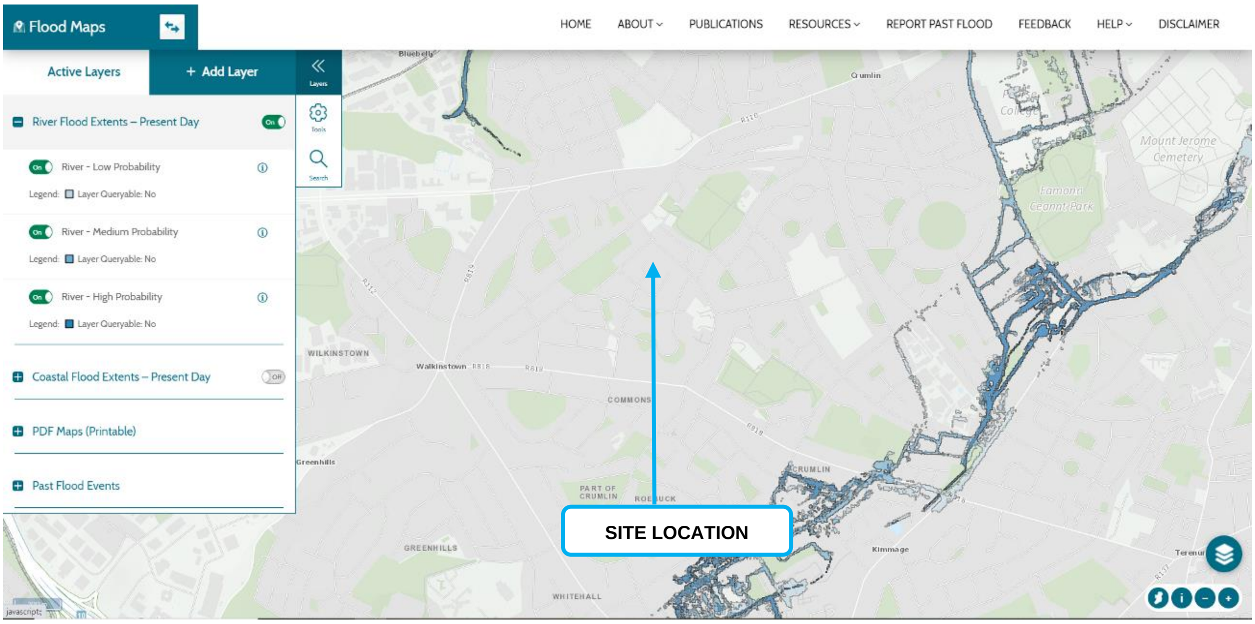


Figure 3.1 - Fluvial Flooding (0.1%, 1.0% & 10% AEP)

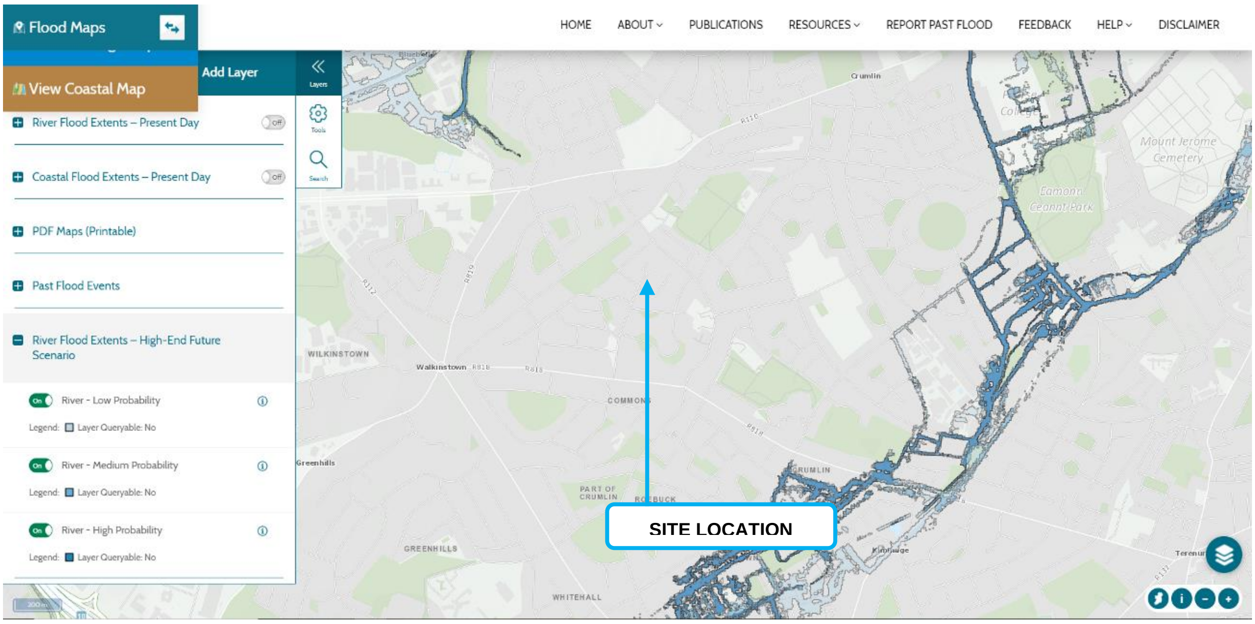


Figure 3.2 - Fluvial Flooding (0.1%, 1.0% & 10% AEP inc Climate Change)

<u>Tidal Flood Risk</u>

The OPW ECFRAM coastal flood risk analysis for 10%, 0.5% and 0.1% AEP return periods show the site is outside the extents of the coastal flood events as seen in fig 3.3.

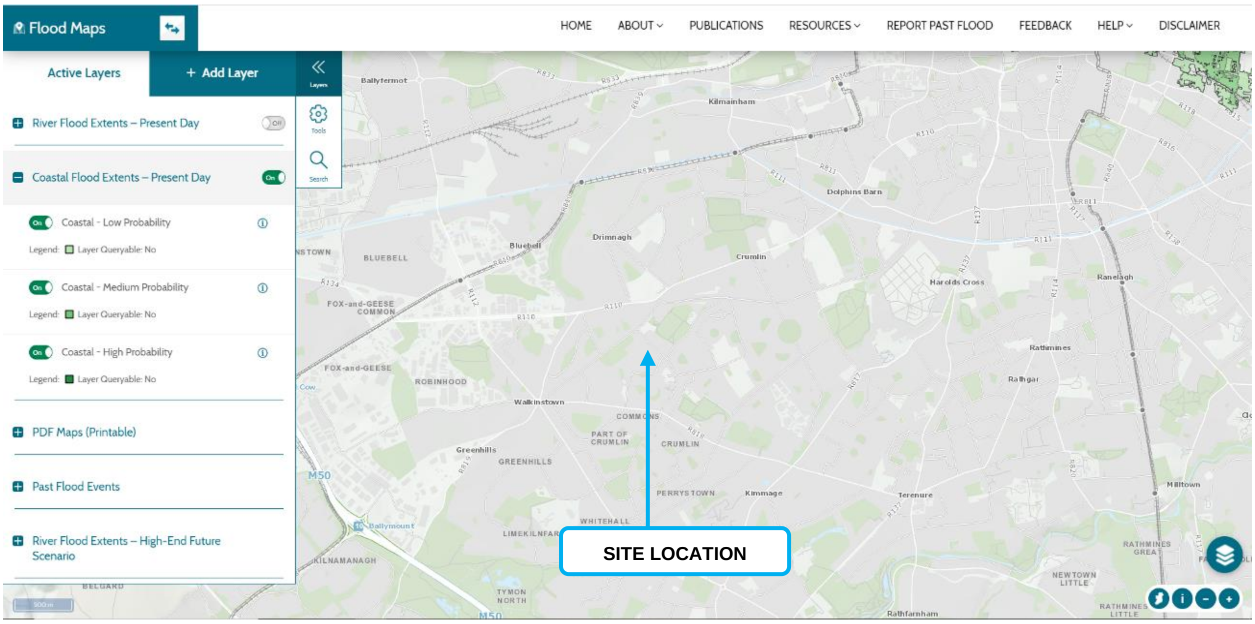


Figure 3.3 - Tidal Flooding (0.1%, 1.0% & 10% AEP)

Further information is also included in relation to flood levels associated with an increase in rainfall due to future climate change. Figure 3.4 represents the flood extents with an allowance for a twenty percent increase in rainfall in the future. The information provided on the map indicates that there will be no impact on the proposed development site due to Tidal flooding when considering climate change.

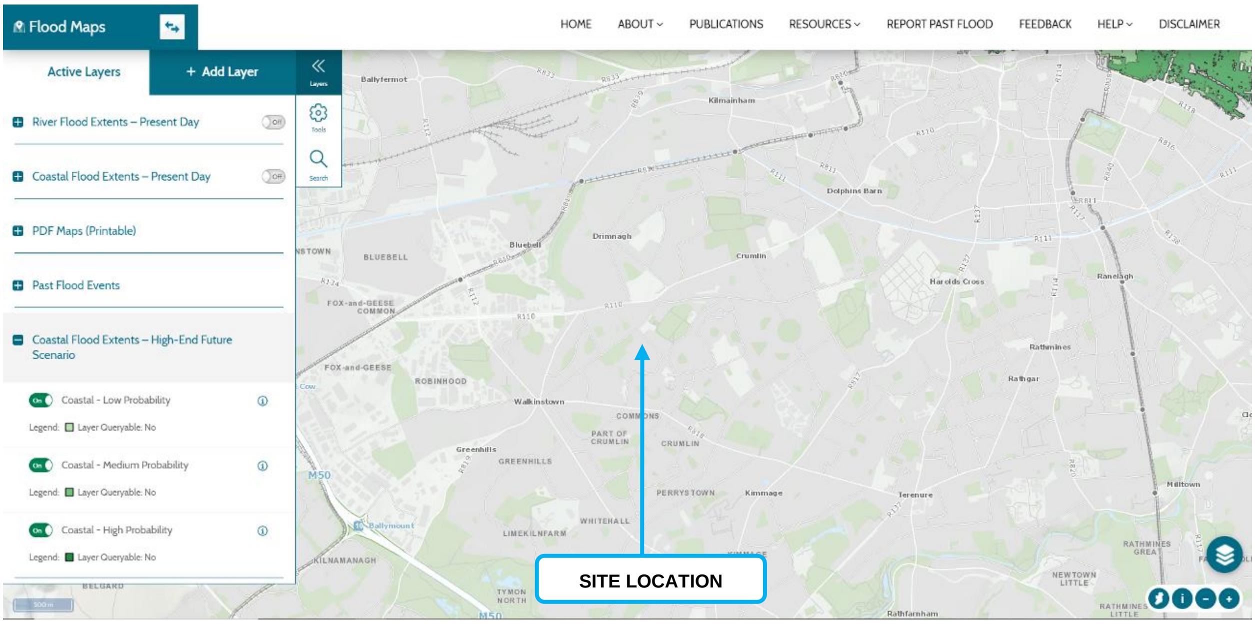


Figure 3.4 - Tidal Flooding (0.1%, 1.0% & 10% AEP inc Climate Change)

<u>Pluvial Flood Risk</u>

Furthermore, the OPW's ECFRAM Study also assessed effects of pluvial flooding in the area. An extract from the Pluvial maps of Dublin City as part of the Flood Resilient City Project in figure 3.5 below shows the pluvial extents for a 0.5% AEP,1.0% AEP and 10% AEP event.

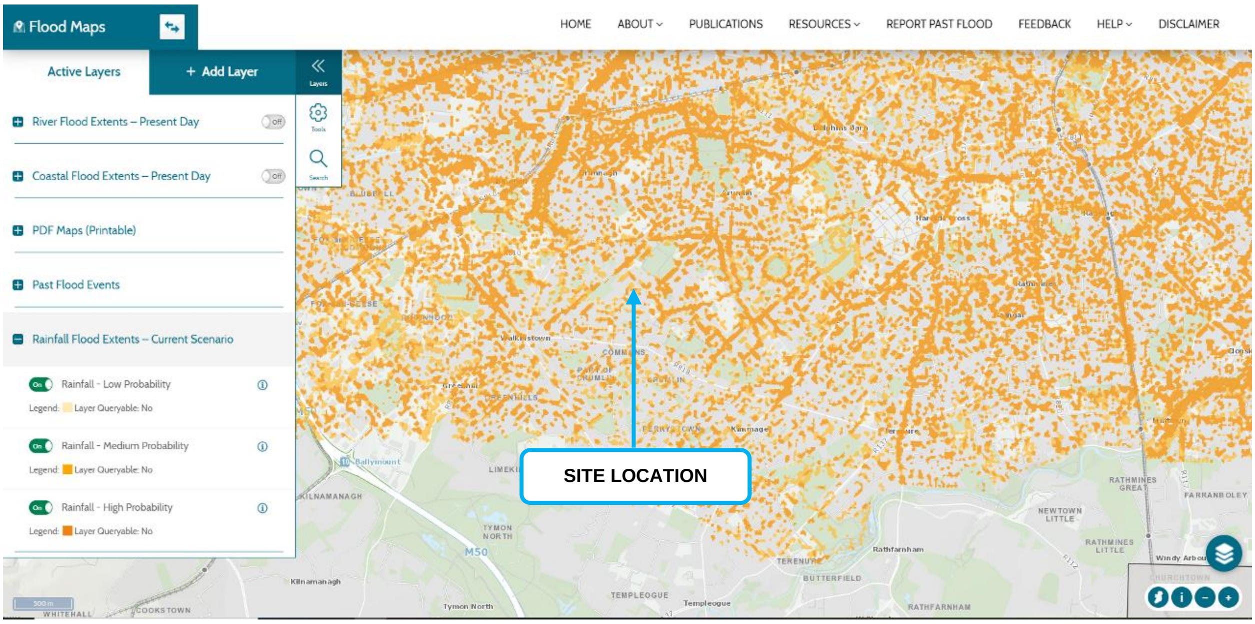


Figure 3.5 - Pluvial Flooding ((0.1%, 1.0% & 10% AEP)

The above extract indicates flood levels impacting the site from Pluvial sources. For a 1 in 200year AEP flood event the levels indicated are 0.1-0.25m in areas of the site.

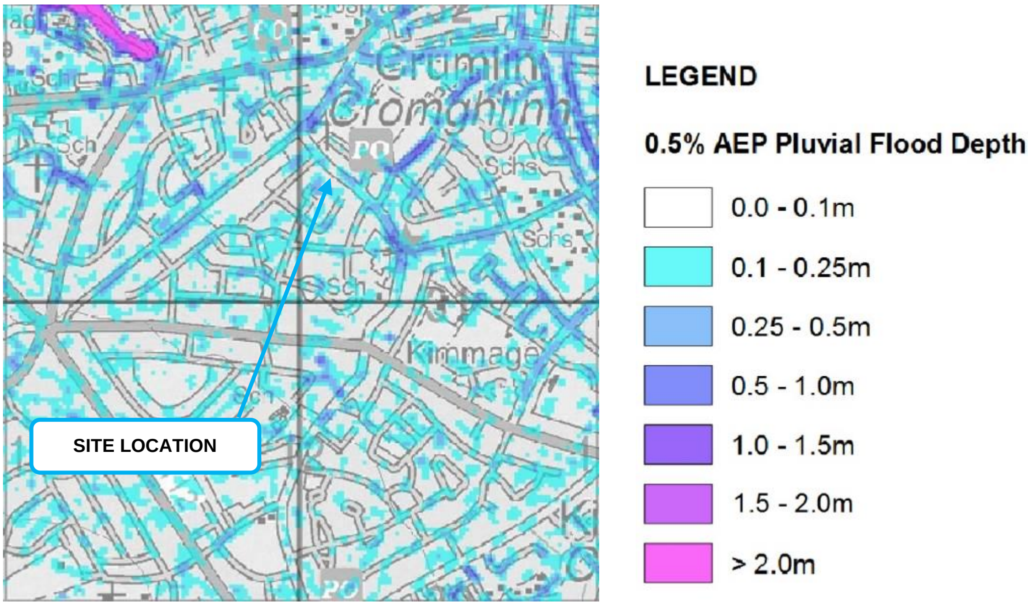


Figure 3.6 - Pluvial (0.1% AEP)

The above extract in Figure 3.6 is taken from the 1 in 100yr AEP Flood Prediction level map. For a 1 in 100year AEP flood event it can be seen the levels indicated are 0.1m – 0.25m in areas of the site.

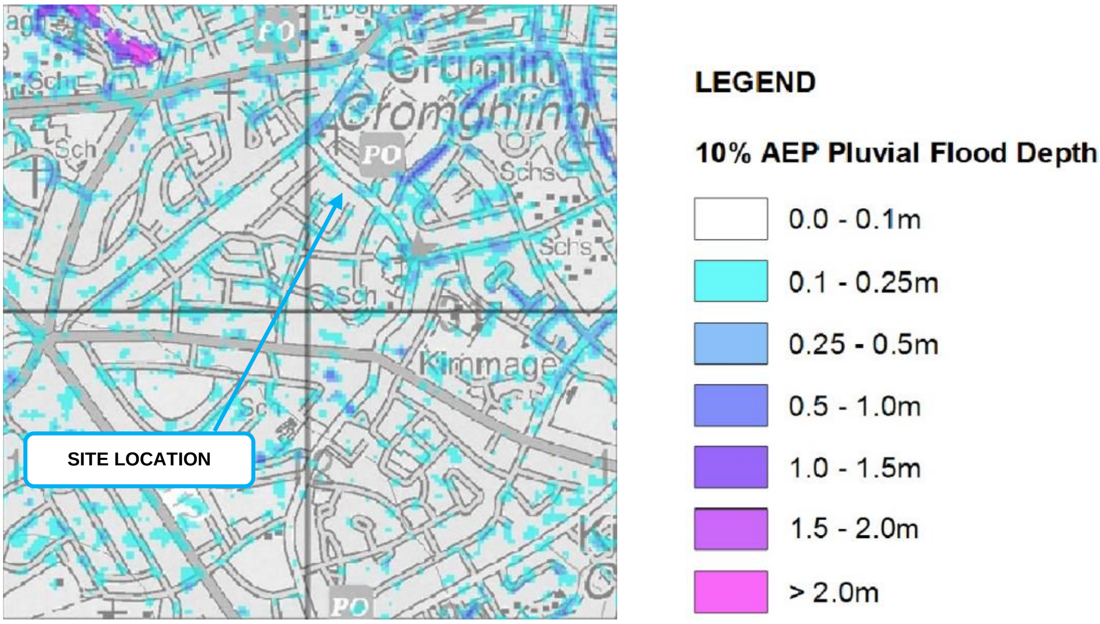


Figure 3.7 - Pluvial (10% AEP)

The above extract in Figure 3.7 is taken from the 1 in 10yr AEP Flood Prediction level map. For a 1 in 10year AEP flood event it can be seen the levels indicated are 0.1-0.25m in areas of the site.

3.2.2 Dublin City Council Strategic Flood Risk Assessment

Appendix 7 of the Dublin City Council Development Plan 2016-2022 comprises the Strategic Flood Risk Assessment (SFRA) which uses the draft ECFRAM mapping as its basis for identifying areas at flood risk. The SFRA identifies the subject site in Map 2. refer to figure 3.6 on the following page for extents of flood risk identified by the SFRA. Within the same, it is noted that the proposed development site is not located within the Flood Zones A or B, and therefore located in Flood Zone C i.e. Low probability of flooding.

3.2.3 Irish Coastal Protection Strategy Study (ICPSS)

After reviewing the ICPSS coastal flood extents maps, the subject site is outside the modelled flood extent for Fluvial and Coastal AEP events, i.e. the subject site is within Flood Zone C as shown in Figure 3.12.

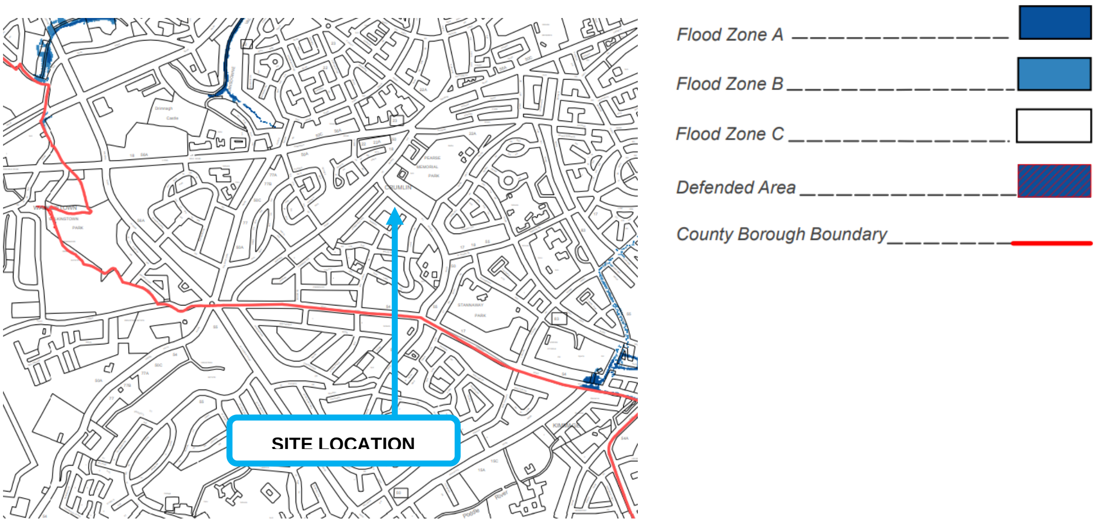


Figure 3.8 - Extract from DCC Flood Zone Map

3.2.4 Topographical Survey

After reviewing the Topographical survey, the subject site is level. The survey indicates that the existing ground level varies from approximately +45.03m AOD to +45.52m AOD with levels at +44.67m AOD along the adjacent street. The lowest floor level on the site is the lower ground floor level of Glebe House itself. It is proposed to retain this floor level as existing at +43.95m AOD.

3.2.5 Walkover Survey

From a walkover of the site the subject site is roughly flat with a slight slope down to the North (Towards St. Agnes Road) and no evidence of flooding or flow paths are evident on site. The walkover survey confirmed the proposed development site is as expected and ties in with the topographical survey.

3.2.6 Other Sources

Other information sources were consulted to determine if there was any additional flood risk to the subject site, these included;

- Soil data from – The site consists of made ground soils on Gravely Clay. A full site investigation will confirm the site soil build up.

- Existing Local Authority Drainage Records – The surrounding area uses a combined drainage network. To the North of the development site an existing 300mm diameter combined sewer services the site which runs under St. Agnes Road. To the South a 225mm diameter combined sewer runs along Somerville Drive.

- Historic Maps – the area is part of Crumlin village area.

3.3 Source-Pathway-Receptor Model

A Source-Pathway-Receptor model was produced to summarise the possible sources of floodwater, the people and assets (receptors) that could be affected by potential flooding (with specific reference to the proposals), see Table 3.2. It provides the probability and magnitude of the sources, the performance and response of pathways and the consequences to the receptors in the context of the mixed-use development proposal. These sources, pathways and receptors will be assessed further in the initial flood risk assessment stage.

Source	Pathway	Receptor	Likelihood	Impact	Risk
Tidal	Subject Site outside flood extents	Ground Floor	Very Unlikely	-	-
Fluvial	Proposed development site outside fluvial flood zone	-	Very unlikely	-	-
Surface Water Drainage	Flooding from surcharging of the developments drainage system	Ground Floor	Very unlikely	-	-
Groundwater Flooding (Pluvial)	Rising ground water on the site	Ground Floor	Likely	Medium	Medium
Infrastructural – Human or Mechanical Error	Blockage of new drainage network	Ground Floor	Possible but Unlikely	-	-

Table 3-2 - Source-Pathway-Receptor Analysis

The following section provides a summary of the results of this Source-Pathway-Receptor flooding model for the subject site.

3.4 Source-Pathway-Receptor Model Results

As it can be seen in the previous flooding analysis, the proposed development site is at risk of flooding from Pluvial sources.
This can be considered during a 200 year storm event. Consequently, an initial flood risk assessment will follow to provide further detail on the causes, effects and possible mitigation measures for the sources of flood risk identified above.

4 Stage 2- Initial Flood Risk Assessment Stage

The main sources of flood risk identified from Stage 1 are;

- A low pluvial flood risk associated with the proposed developments proposed drainage network. This flood risk considers the 1 in 200 year rainfall event.

4.1 Initial Pluvial Flood Risk Assessment

The Source-Pathway-Receptor model identified that there could be potential for pluvial flood risk within the development site related to rainfall exceeding the infiltration rate of the ground.
It should be noted the entire site is not at risk from pluvial flooding. The flood extents noted in the OPW's ECFRAM are concentrated to the centre of the site corresponding with lower existing site ground levels. The lower ground floor level of Glebe House has been assessed for Flood risk and is outside the predicted scope of flooding for the site.

4.2 Initial Ground Water Flood Risk Assessment

The Source-Pathway-Receptor model identified that groundwater flood risk on the proposed site is likely. From surface water soakaway test holes, the ground water table level was established at approximately 2.0m below existing ground level which would be situated at a level of +42.45mAOD. The height and location of the site indicates that the ground water source is unlikely to be tidal.

The results from the site investigation works would suggest that no ground water shall be encountered during construction.

4.3 Flood Zone Category

Following the assessment of the flood risk to the site and the available information it is considered that the proposed development site is located outside a potential flood zone i.e. Flood Zone C, as defined by the Guidelines and indicated by the Irish Coastal Protection Strategy Study and Dublin City County Strategic Flood Risk Assessment.

Ground Water/Pluvial Flood Risk has been assessed as being low.

5 Stage 3 – Detailed Flood Risk Assessment

The detailed Flood Risk assessment stage will look more closely at how the proposed development will mitigate flood risk from the identified source.

In regard to the low pluvial flood risk, the detailed flood risk assessment stage will assess this in relation to the following;

- Proposed development plans (FFLs, site vulnerability, building extents).
- Impact of proposed development on adjacent properties.
- In relation to the objectives set out in the DCC SFRA justification test.
- Any residual risks
- Flood exceedance.

5.1 Maximum Flood Levels

The maximum predicted spot flood levels from Pluvial Sources are from 0.1m to 0.25m in depth above existing ground level. The ground levels vary across the site with the levels at the point of flooding at approximately +45.035m AOD. The proposed finished floor level is +45.035mAOD. The existing floor level of Glebe House is +43.95m AOD.

It is noted that the current site is impermeable concrete surfaces. It is proposed to replace these surfaces with permeable paving to allow infiltration of surface water to the ground below. The paving will be constructed with sufficient storage volume under to cater for the 1 in 200-year storm event.

In the worst-case scenario that the paving is blocked, and water begins to pool on the surface, the paving will be constructed with falls away from the building faces. The operational management plan will include regularly cleaning of the paving surfaces to reduce risk of blockages.

It should be noted that the existing drainage records for the area show the combined sewer invert level is highest at +43.35mAOD which is below the lowest proposed finished floor level. However, in the event of pluvial flooding, it is proposed to install non-return valves on the surface water sewer connection to prevent sewer backflows into the development. A summary of the proposed non-return valves is outlined below:

5.2 Detailed Pluvial Flood Risk Assessment

The Dublin City Flood Resilient City Project shows pluvial flood depths for the 1%AEP model to be in 0.1m - 0.25m range. The proposed finished floor levels and surrounding ground levels indicate a risk to the site from pluvial sources.

The existing site is impermeable concrete surfaces. It is proposed to replace these surfaces with permeable paving to allow infiltration of surface water to the ground below. The paving will be constructed with sufficient storage volume under to cater for the 1 in 200-year storm event.

In the worst-case scenario that the paving is blocked, and water begins to pool on the surface, the paving will be constructed with falls away from the building faces. The operational management plan will include regularly cleaning of the paving surfaces to reduce risk of blockages. Flood resilient design measures shall be incorporated into the structure to ensure no risk of flood water entering the site.

As noted above the existing floor level of Glebe House is +43.95m AOD which is below the proposed finished ground levels of +45.035m AOD. Glebe House is outside of the predicted floor extents as can be seen in the figure below. However there is a residual risk that the flood waters extend beyond the predicted limit. In this scenario it is proposed to protect the lower floor of Glebe house through the use of raised threshold to lower floor levels and a flood gate across the entrance to the lower ground floor unit.

5.3 Mitigation Measures

Proposed mitigation measures to address residual flood risk are summarised below;

- Installation of permeable paving with sufficient sub surface storage volume will allow for the predicted flood waters to be stored under the surface and infiltrate within the site after rainfall subsides.

- The thresholds to the ground floor level of the proposed new apartment blocks will all be constructed to a minimum of 300mm above the proposed ground level. This will offer protection above the predicted 0.1m-0.25m flood level.

- A demountable flood gate will be installed at the entrance steps to the lower ground floor level of Glebe House to provide protection above the predicted 0.1m-0.25m flood level.

- The proposed drainage system to be maintained on a regular basis to reduce the risk of a blockage. This new network shall also include the use of non-return valves to prevent the passage of water within the public network back into the proposed new development.

ACO Anti-flood Systems

ACO QUATRIX®

Backflow valve with access chamber

The ACO QUATRIX® backflow valve is an in-line Type 3 automated anti-flooding device conforming to BS EN 13564 suitable for black water connections (faecal wastewater) installed with its own access chamber.

Versatile design

The ACO QUATRIX®, which installs into solid floor construction with connection to 110mm and 160mm Ø drain pipe, features a height adjustable access chamber with optional DPM bonding flange. Access is gained through a reversible cover designed for tiled or cementitious floor finishes which rotates for ease of alignment with floor tiling and is fully sealed. The IP67 rated motor/valve body ideal for internal or external applications.

Reliable function

Under normal conditions the backflow flaps are open allowing waste water to flow to the drain. When backflow occurs, reversing the direction of flow, water will reach a certain level within the pipe activating a pressure sensor which is monitored at the control box.

The motorised flap activates and shuts under pressure sounding an audible alarm accompanied by a flashing light. When backflow abates the process is reversed. In the event of a power cut, the control box has a 24 hour power back-up.

Quatrix backflow devices have a 2-position secondary flap for manual operation.

1. Locked open (normal)
2. Locked shut (for emergency use or long periods of non-use)

Key features

- Tested to BS EN 13564
- Backflow valve with sealed access chamber height adjustable access shaft rotates for tile alignment
- Double flap security with manual override
- Reversible access cover for tile infill or cement floor finishes
- Fits to 110mm and 160mm Ø pipes
- All parts removable for cleaning
- DPM flange option
- For internal or external applications

ACO building drainage

ACO Anti-flood Systems

Technical

ACO QUATRIX®

- Automatic backflow valve for use in black water or domestic grey water, IP67 rating
- Power operated flap and manual locking flap
- IP56 rated control box with visual and audible alarm
- Lockable access chamber adjusts for height and rotation
- Reversible access cover 300mm x 300mm Load Class K3 to BS EN 1253
- Connection Ø, 110mm and 160mm pipes
- Weight, 17kg
- 500mA passive Building Management System output interface
- Optional DPM flange

Part No	DN OD (mm)	L mm	H mm	H1 mm
620370	110	460	297	426 - 512
620371	160	500	272	426 - 512

Ordering

Reference	Ø (mm)	Part No
ACO Quatrix-K with access chamber and cover	110	620370
ACO Quatrix-K with access chamber and cover	160	620371
100mm chamber extension piece (option)	110/160	620381
DPM flange (option)	110/160	620382

ACO Building Drainage
ACO Business Centre, Caxton Road, Bedford, Bedfordshire MK41 0LF
Tel: 01462 816666 Fax: 01462 851490
e-mail: buildingdrainage@aco.co.uk
Website: www.acobuildingdrainage.co.uk

ACO building drainage

Figure 5.2 Non-return valve

The valves will also be wired into the overall Building Management System.

- The proposed drainage system shall be maintained on a regular basis to reduce the risk of a blockage.

5.3.1 Effectiveness of Mitigation Measures

It is considered that the flood risk mitigation measures once fully implemented are sufficient to provide a suitable level of protection to the proposed development. The proposed development will not increase the run-off rates when compared with the existing site and satisfies the requirement of the SFRA to reduce flooding and improve water quality.

5.4 Residual Risks

Remaining residual flood risks, include the following;

- Overground flood exceedance or (pluvial) flooding where local drainage infrastructure is surcharged during high rainfalls and rainfall rates exceed infiltration rates of the permeable paving. In this case the paving will be installed at a fall away from the buildings to prevent flooding.

5.5 Justification Test

The preparation of this report follows the guidelines stated within the Strategic Flood Risk Assessment for Dublin City. The criteria for the proposed development would classify the proposed scheme as a highly vulnerable development in the area of Flood Zone C. According to the matrix of vulnerability versus flood zone within the SFRA this type of development is considered appropriate and would not require a justification test.

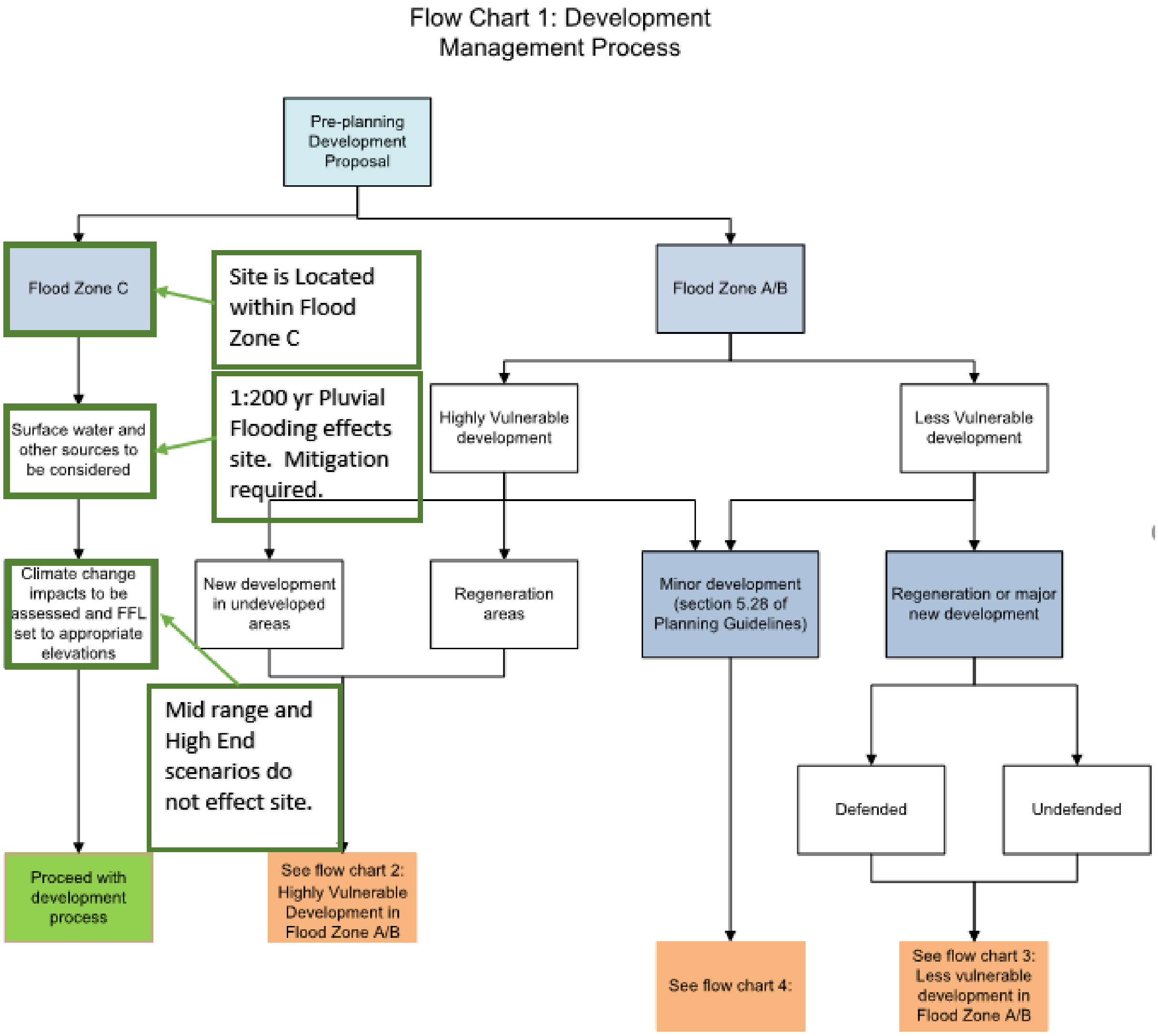


Figure 5.1 DCC Development management process extract identifying path for Zone C

6 Conclusion

This SSFRA concludes the following;

- This Site Specific Flood Risk Assessment for the proposed demolition of existing industrial units, concrete hardstanding and construction of residential units at Glebe House, Crumlin was undertaken in accordance with the requirements of the "Planning System and Flood

Risk Management Guidelines for Planning Authorities", November 2009 and the Dublin City Council Development Plan 2016-2022 Strategic Flood Risk Assessment.

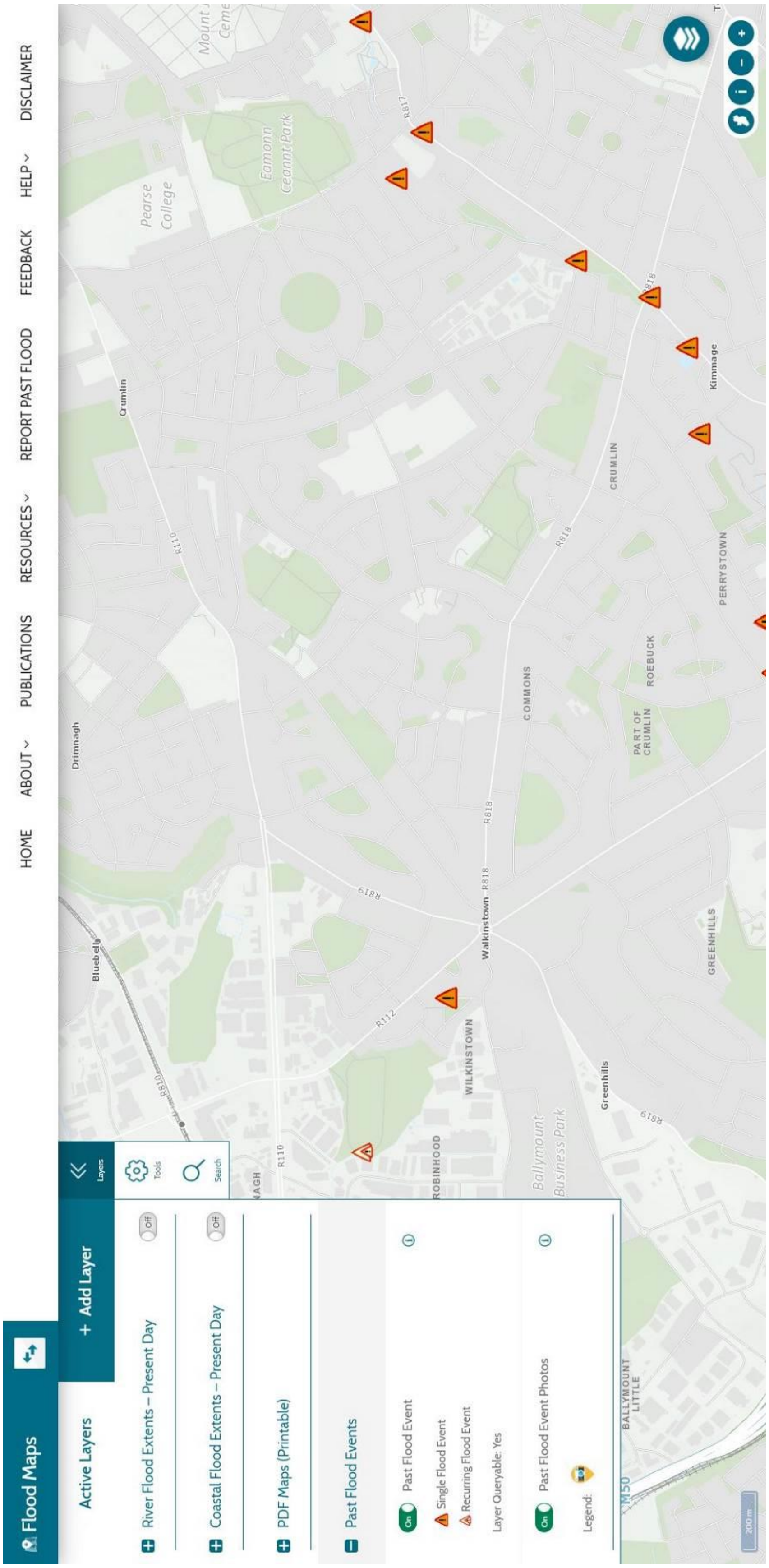
- The proposed type of development for this site is to be Residential. Residential developments are categorised by the Guidelines as ***Highly vulnerable development*** and appropriate to be located within Flood Zone C without the requirement for a justification test.

- A possible source of flood risk from the Pluvial flooding. This risk is mitigated by installation of permeable paving and suitable design of the drainage network including non-return valves, regular maintenance and inspection of the network and establishment of exceedance overland flow routes.

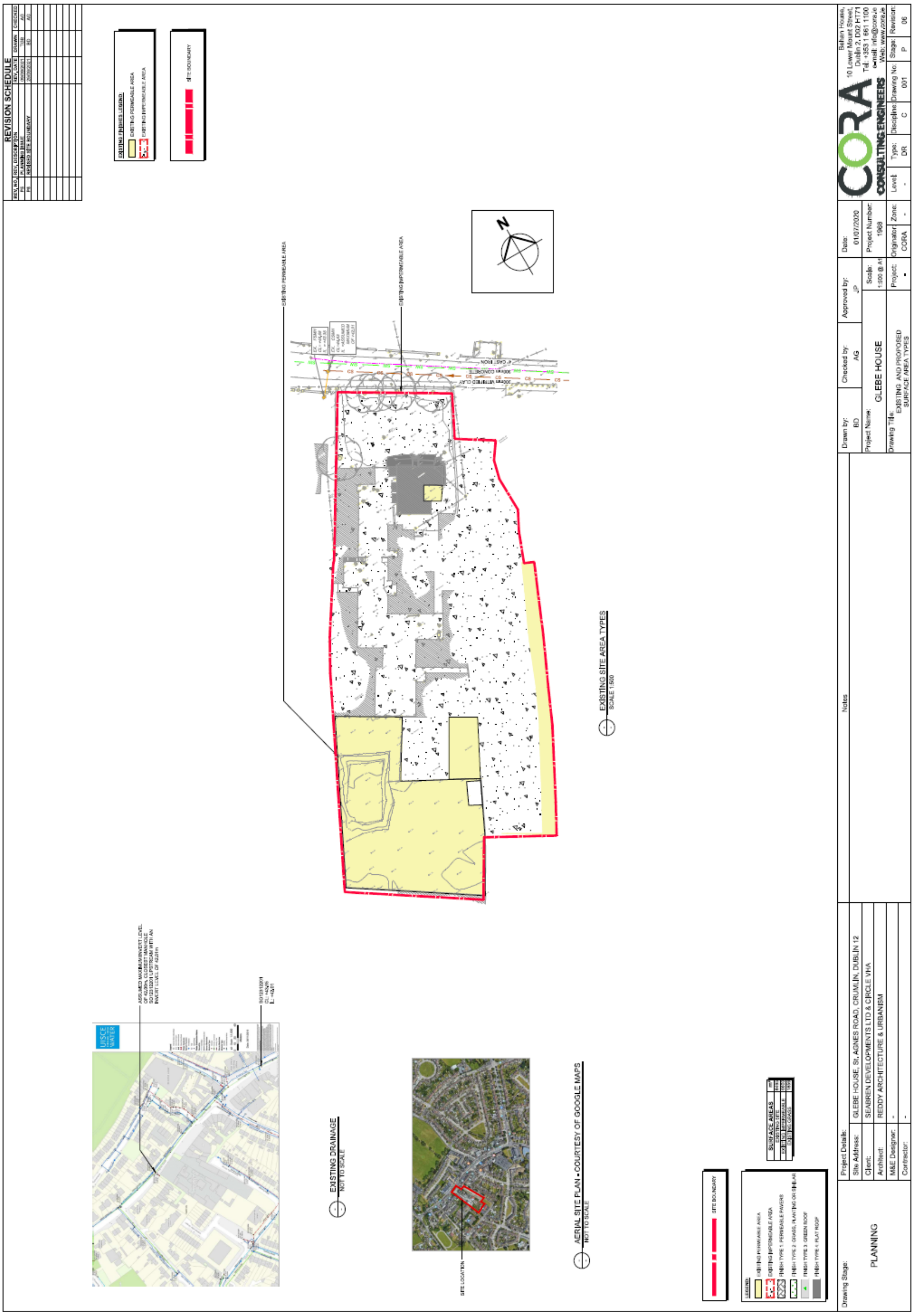
- The development's drainage design includes for a 30% climate change allowance.

- The proposed development will not increase the surface water run-off rate when compared with the existing site and satisfies the requirement of the SFRA to reduce flooding and improve water quality.

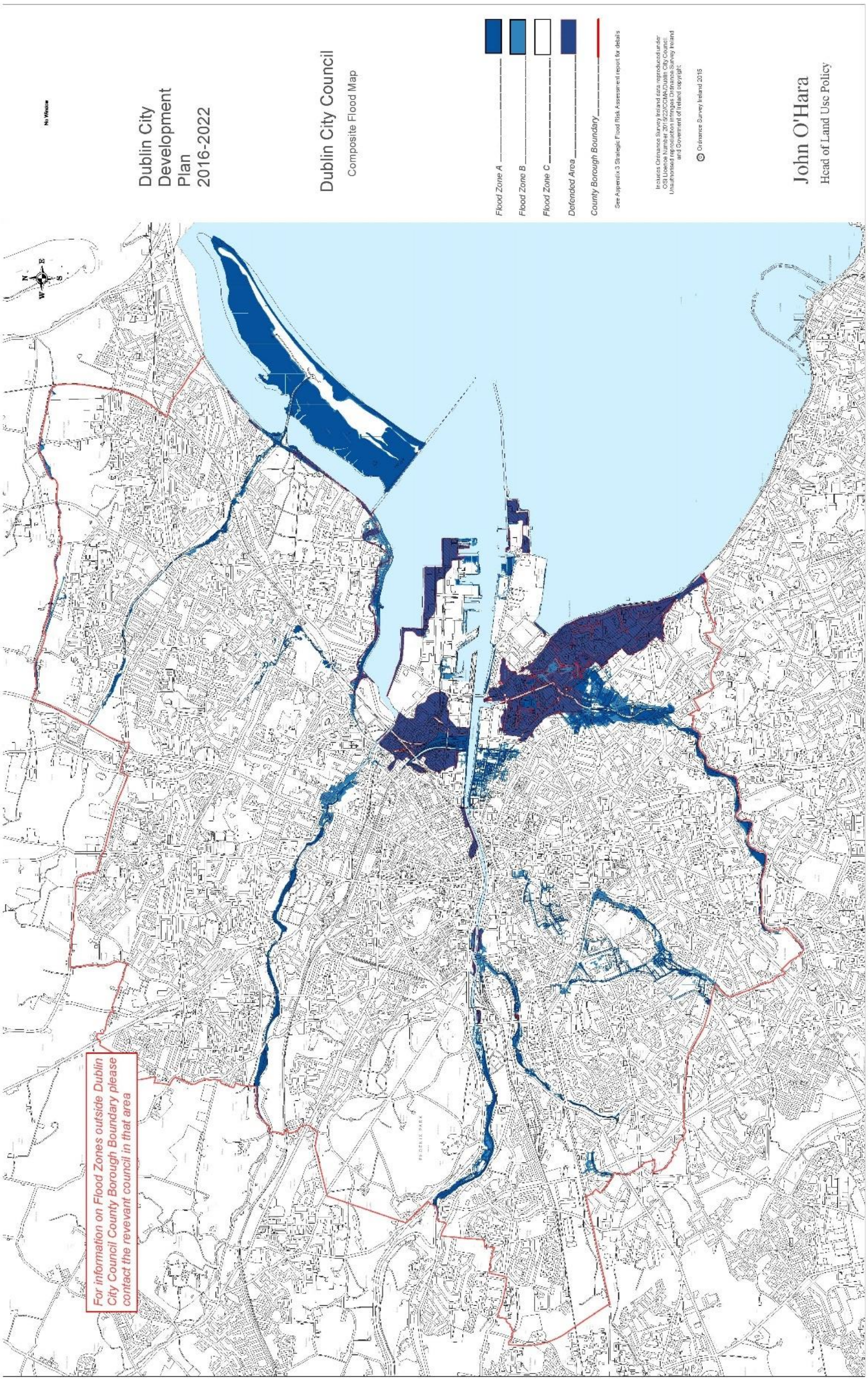
7 Appendix A – OPW Flood Map



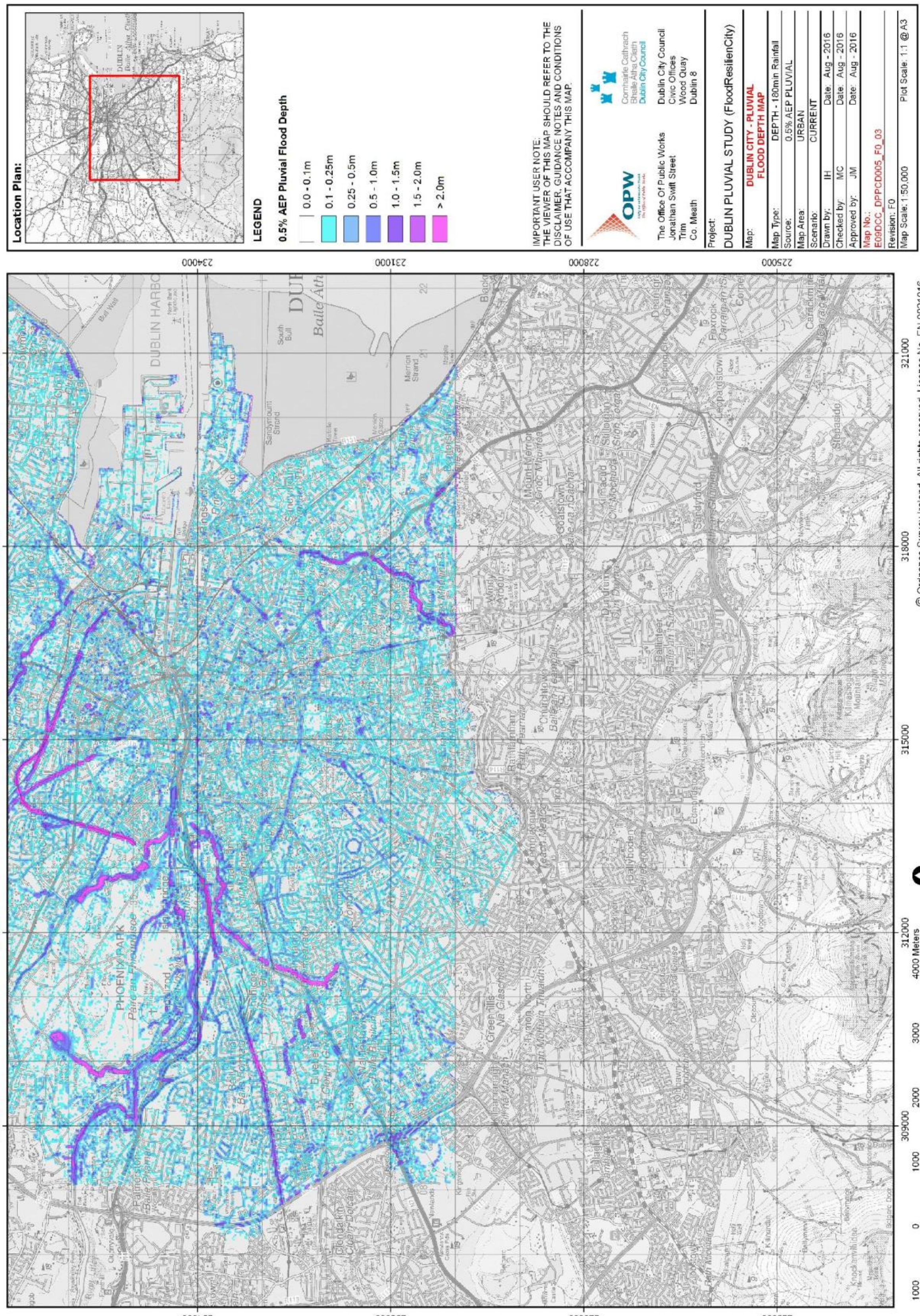
8 Appendix B – Existing Site



9 Appendix C – DCC Composite Flood Zone Map



10 Appendix D – Eastern CFRAM Flood Mapping



11 Appendix E – Existing Drainage Records